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Remarks

The Title has been amended to address a request by the Examiner. Paragraphs 0011 and 0015 of the originally-filed application (corresponding to paragraphs 0021 and 0025 in the published application) have been editorially amended as shown above. Claim 4 and renumbered claim 17 have been rewritten in independent form incorporating all the limitations of the base claims and any intervening claims. Antecedent basis for the amendment to claim 14 may be found in the Written Description at, e.g. paragraph 0035 (corresponding to paragraph 0045 in the published application).

Objection to the Specification

The Title was objected to on grounds that it was too generic. This objection should be rendered moot by the amendment shown above.

Rejection of Claims 1, 2, 5-15 and 18-24 Under 35 U.S.C. §103(a)

Claims 1, 2, 5-15 and 18-24 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent Application Publication No. US 2003/0203101 A1 (Haubrich et al.) in view of U.S. Patent No. 5,866,195 (Lemelson) on grounds, *inter alia*, that:

"Haubrich et al teaches forming patterned structures on a substrate to form electrophoretic displays, circuits, etc. The process steps comprise printing on the substrate a strippable polymer-based maskant material which represents the desired pattern; depositing on the patterned substrate a conductive metal which is substrate adherent; and removing the strippable material with conductive material thereon by means including mechanical (physical stripping/ adhesive tape peeling, [0043]. It is the Examiner's position that this would have reasonably suggested other mechanical/ physical means well-known to remove coatings such as impact/media blasting. The process leaves conductive material on surfaces where the strippable maskant was NOT present, and vice-versa [0029]. The strippable maskant polymer pattern is applied by printing methods such as screen printing, ink jet, gravure, etc [0018]. The method provides the benefit of a simpler, cleaner method than photolithography or etching to selectively form patterned surfaces. Applying a second, substrate adherent

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polymer rather than a metal to the patterned substrate surface is not taught." (see the Office Action at page 3, numbered paragraph 6).

In applicants' claimed methods, a first (release) polymer is applied to a portion of a substrate in a desired pattern. A second (substrate-adherent) polymer is applied over the pattern and over at least a portion of the substrate. In the method of rejected claims 1, 2 and 5-13 the second polymer is applied "over the pattern and over at least a portion of the substrate in a continuous layer having a substantially constant height with respect to the substrate" and the second polymer is mechanically removed from the pattern. In the method of rejected claims 14, 15 and 18-24 the second polymer is applied in "a continuous layer ... over the pattern and over at least a portion of the substrate" and an adhesive tape is employed to remove second polymer "atop the pattern" while leaving "a portion of the second polymer adhered to the substrate in a negative of the pattern". The combination of steps or materials employed by applicants in these rejected claims can facilitate formation of well-defined, accurate pattern negatives, e.g., as shown by Example 1 and the profilometer measurements in Fig. 8:

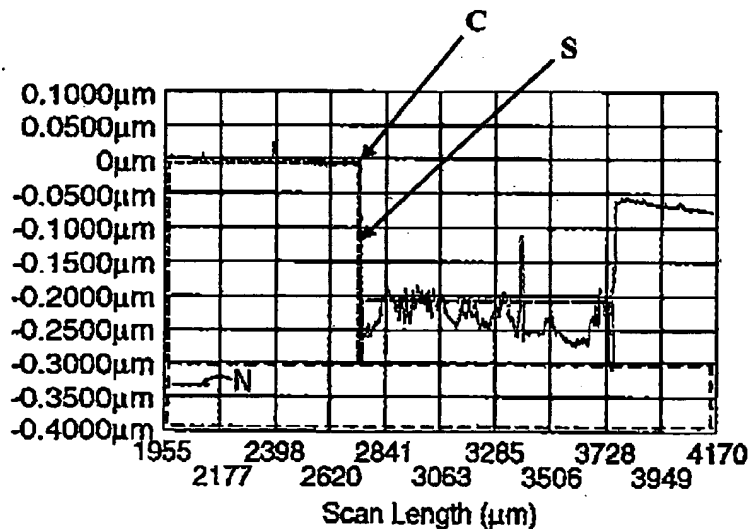


Fig. 8

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The arrow labeled "S" above denotes a sidewall having a steep and substantially vertical shape. The arrow labeled "C" above denotes a corner cusp having especially good definition.

The pattern formed by the first polymer may also be removed to provide a finished article that likewise has a well-defined, accurate pattern negative, e.g., as shown by the profilometer measurements in Fig. 9:

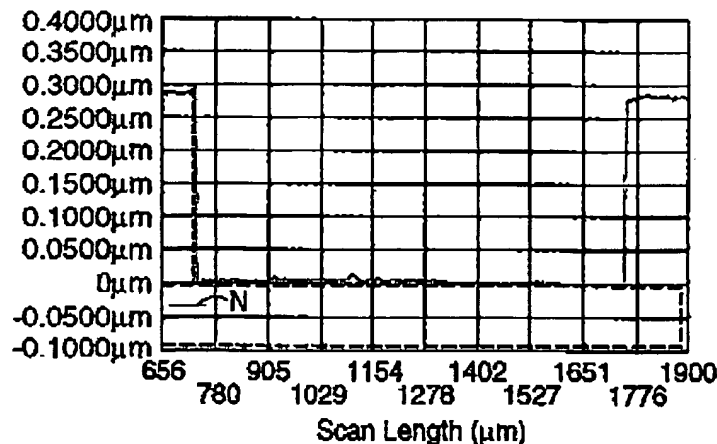


Fig. 9

Good negative pattern definition is important, for example, when fabricating microelectronic devices. Without intending to be bound by theory, the results obtained by applicants may be aided by several factors including the application of the second polymer layer over the pattern formed by the first polymer, the use (in rejected claims 1, 2 and 5-13) of a continuous second layer having a substantially constant height with respect to the substrate, the removal of the second polymer from the pattern formed by the first polymer, and the capability to carry out such removal without requiring the use of a solvent. These factors can permit selection of first and second polymers that will separate easily from one another, can facilitate cleaner removal of the second polymer, can permit formation of a very thin and easily-removed second polymer layer atop the pattern, and can permit the avoidance of solvents that might otherwise remove more or less material than desired and yield a poorly defined final article (see e.g., paragraph 0022).

Haubrich et al. show schematic views of various patterned electrode structures but do not provide profilometer results. Haubrich et al. do not apply "a substrate-adherent polymer

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over the pattern and over at least a portion of the substrate in a continuous layer having a substantially constant height with respect to the substrate" as recited in rejected claims 1, 2 and 5-13 and do not apply "a continuous layer of a substrate-adherent polymer over the pattern and over at least a portion of the substrate" as recited in rejected claims 14, 15 and 18-24. Haubrich et al. do not show or suggest the methods of rejected claims 1, 2, 5-15 or 18-24.

The Office Action addresses the deficiencies in Haubrich et al. by combining it with Lemelson, asserting that:

"Lemelson teaches that conductive polymers may be used for circuitry and other electronic applications, and may be applied to substrates by dip or roller coating, etc [col. 21, 39-51], and further col. 22, 19-25 teaches the equivalence of such conductive polymers with metals and semiconductors, and the replacement of such conventional materials by the conductive polymers, because of the expectation of equivalent electrical conduction." (see the Office Action at pages 3-4, numbered paragraph 6).

Reconsideration is requested. Lemelson does not provide any working examples or data that would enable a person having ordinary skill in the art to determine whether a conductive polymer (or for that matter any polymer) could be substituted for the conductive metal oxide layer in Haubrich et al.'s process. If a person having ordinary skill in the art was asked to consider such a substitution, the decision would in any event not be made based on an "expectation of equivalent electrical conduction". Conductivity relates to a possible end use for certain articles that might be made by Haubrich et al. First the article has to be made, and in this instance doing so involves many important factors other than conductivity. Haubrich et al. apply a conductive metal oxide (e.g., sputter-deposited ITO) atop their pattern. Most of Haubrich et al.'s embodiments also require use of a solvent (e.g., acetone) capable of penetrating the conductive metal oxide and removing it and an underlying organic material from some areas and leaving the conductive metal oxide in other regions. A conductive polymer and a conductive metal oxide would exhibit substantially different behavior with respect to Haubrich et al.'s stripping solvent. Nothing in Lemelson addresses this issue, and nothing in Lemelson provides a proper basis for substituting a conductive polymer for a conductive metal oxide in Haubrich et al.'s solvent-stripped embodiments.

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Haubrich et al. also refer to the use of adhesive tape to remove ITO from an area printed with masking ink (and leave ITO in an area not so printed) or to remove ITO from an area not printed with masking ink (and leave ITO in a printed area). Haubrich et al. say that the removal result will depend "on the cohesion strength of the ink and the adhesion strength of the ink-PET and ITO-PET interfaces" (see Haubrich et al. paragraph 0043). Lemelson does not provide information that would enable a person having ordinary skill in the art to assess whether a conductive polymer could be substituted for a conductive metal oxide in Haubrich et al.'s adhesive tape embodiment. Lemelson has no working examples, no data and no discussion of adhesive tape removal of a portion of a layer. The asserted equivalence in Lemelson is based solely on statements at col. 22, lines 19-25 which are part of the following text at col. 22, lines 19-32:

"The conducting polymers described above or other such electrically conducting and semi-conducting polymeric materials, may also be employed in place of one or more of the metal and semiconducting films and layers to construct electrical circuits of the types shown in FIGS. 1 to 12 by either applying same as thin films or coatings to substrates or previously deposited materials and either chemically converting select portions of such conducting films to non-conducting compounds thereof and/or by chemically or dissolving or etching select portions of such conducting polymer films or layers, or otherwise removing same such as by electron or laser beam etching, burning or eroding same to provide circuit elements and interconnects as described and illustrated."

The quoted passage refers to the possible use of a variety of circuit trace formation schemes and to the possible removal of select portions of a conducting or non-conducting film by a variety of additional schemes, but does not provide a proper basis for substituting a conductive polymer for a conductive metal oxide in Haubrich et al.'s process. Lemelson does not discuss the cohesive strength and interfacial adhesion factors referred to by Haubrich et al., and says nothing regarding removal of a portion of a covering layer using adhesive tape. Aside from a one-word mention of the possibility of "eroding", Lemelson does not discuss mechanical removal of a portion of a covering layer. A person having ordinary skill in the art would not be provided with sufficient information to know whether a conductive polymer

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could be substituted for the conductive metal oxide in Haubrich et al.'s process. A decision to do so would not be made based on conductivity (which although not mentioned by Lemelson ordinarily is less at equivalent film thicknesses for a conducting polymer than for a conductive metal oxide such as ITO) but would instead have to be made based on factors and information nowhere provided by Lemelson.

The Office Action also asserts:

"Per claim 2, the strippable maskant polymer necessarily has a lower surface energy than the substrate adherent polymer to allow its removal while maintaining the conductive polymer on the substrate. Thus, it would have obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Haubrich et al by substituting the conductive polymers of Lemelson for the metals of the conductive layer of Haubrich et al because of the expectation of forming patterned conductive articles for electronic applications, wherein the conductive polymers substituted for the conductive metals would have reasonably provided equivalent performance." (see the Office Action at page 4, numbered paragraph 6).

Reconsideration is requested. Haubrich et al. refer to one embodiment employing a "solvent soluble first material that has a low surface tension" and a "second, water-based material that is repelled by the first material" (see e.g., paragraphs 0041 and 0044, Fig. 6C-1 and Fig. 6C-2 which is reproduced below):

Cross-Section

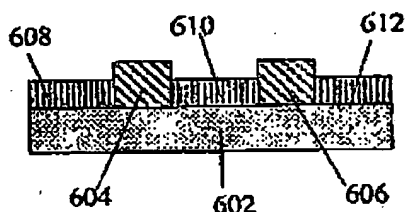


FIG. 6C-2

In the Fig. 6C-2 embodiment the second material is not applied "over the pattern and over at least a portion of the substrate in a continuous layer having a substantially constant height

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with respect to the substrate” as recited in rejected claim 2. If asked to consider the matter, a person having ordinary skill in the art who reviewed Haubrich et al. would assume that the recited repulsion would make it impossible to apply the second material over a pattern formed by the first material. Lemelson does not compare the surface energy of a first and second polymer layer. Even if Haubrich et al. and Lemelson were combined as proposed in the Office Action the result would at best provide Haubrich et al.’s Fig. 6C-2 embodiment and would not provide the embodiment of rejected claim 2.

The Office Action also asserts:

“As to claims 5-8, 18-22, the dimensions and height of the polymer would have been determined by the skilled artisan using routine experimentation for any desired end-use application.” (see the Office Action at page 4, numbered paragraph 6).

Reconsideration is requested. A review of Haubrich et al.’s Drawing will show that Haubrich et al. do not apply a substrate adherent polymer (or for that matter, their conductive metal oxide) over a pattern and over at least a portion of a substrate in a “continuous layer” having a substantially constant height with respect to the substrate” as recited in rejected claims 5-8 and 18-22. Using such a constant height layer can facilitate accurate, high definition removal of portions of the second polymer using an adhesive tape. A person having ordinary skill in the art would not be motivated or enabled by Haubrich et al. to employ the recited substantially constant height, and would not be enabled to do so by “routine experimentation for any desired end-use application”.

Applicants accordingly request withdrawal of the 35 U.S.C. rejection of claims 1, 2, 5-16 and 18-24 as being unpatentable over Haubrich et al. in view of Lemelson.

Rejection of Claims 3 and 16 under 35 U.S.C. §103(a)

Claims 3 and 16 were rejected under 35 U.S.C. §103(a) as being unpatentable over Haubrich et al. in view of Lemelson and further in view of U.S. Patent No. 5,759,525 (Laubacher et al.) on grounds that:

“Haubrich et al and Lemelson are cited for the same reasons previously discussed, which are incorporated herein. A fluoropolymer-based maskant material is not cited.

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"Laubacher et al teaches on column 1, 43-50 that amorphous fluoropolymers have a "smooth, non-stick character" which resists adherence to other polymers, properties which would make the fluorocarbon polymer beneficial as the strippable polymer-based maskant of Haubrich et al. Therefore, it would have obvious to one of ordinary skill in the art at the time the invention was made to modify the method of Haubrich et al in view of Lemelson by utilizing the fluorocarbon polymer materials of Laubacher et al as the strippable maskant because of the low adhesion properties of the fluoropolymer materials, which would make them readily strippable." (see the Office Action at pages 4-5, numbered paragraph 7).

Reconsideration is requested for the reasons already discussed above with respect to the rejection of claim 2. Haubrich et al. do not apply a "continuous layer" of a second polymer over a pattern and over at least a portion of a substrate as recited in rejected claims 3 and 16. Laubacher et al. describe a process for applying an amorphous fluoropolymer to a substrate, forming a pattern on the fluoropolymer and optionally etching the non-patterned areas. Fluoropolymers are very expensive specialty materials and would be rendered even more so by Laubacher et al.'s process.

Haubrich et al. do not indicate that their recited "solvent soluble first material that has a low surface tension" and their recited "second, water-based material that is repelled by the first material" are sufficiently deficient in repellency from one another to require replacing the first material with a fluoropolymer. Haubrich et al. use an apparently inexpensive ink and a clearly inexpensive polyvinyl pyrrolidinone solution in the paragraph 0044 working example. A person having ordinary skill in the art who reviewed Haubrich et al. (with or without Lemelson) would conclude that the Haubrich et al. materials adequately repelled one another for Haubrich et al.'s purposes and would not be motivated or enabled to substitute a much more expensive fluoropolymer for Haubrich et al.'s inks.

Applicants accordingly request withdrawal of the 35 U.S.C. rejection of claims 3 and 16 as being unpatentable over Haubrich et al. in view of Lemelson and further in view of Laubacher et al.

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Conclusion

Applicants have made an earnest effort to address the objections and rejections. The Title has been made more descriptive. The allowable claims have been rewritten in independent form. Haubrich et al. do not apply "a substrate-adherent polymer over the pattern and over at least a portion of the substrate in a continuous layer having a substantially constant height with respect to the substrate" as recited in rejected claims 1, 2 and 5-13 and do not apply "a continuous layer of a substrate-adherent polymer over the pattern and over at least a portion of the substrate" as recited in rejected claims 14, 15 and 18-24. Lemelson does not provide any working examples or data that would enable a person having ordinary skill in the art to determine whether a conductive polymer (or any polymer) could be substituted for a conductive metal oxide layer in Haubrich et al.'s process. A person having ordinary skill in the art who reviewed Haubrich et al. (with or without Lemelson) would conclude that the Haubrich et al. materials adequately repelled one another for Haubrich et al.'s purposes and would not be motivated or enabled to substitute a much more expensive fluoropolymer for Haubrich et al.'s inks.

The Examiner is encouraged to call the undersigned attorney if there are any questions regarding the application or this amendment.

Respectfully submitted on behalf of
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